AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraph beginning at page 1, line 1, as follows:

TITLE ~~OF THE INVENTION~~.

Please amend the paragraph beginning at page 1, line 4, as follows:

BACKGROUND ~~OF THE INVENTION~~.

Please amend the paragraph beginning at page 1, line 5, as follows:

Technical Field ~~of the Invention~~.

Please amend the paragraph beginning at page 1, line 6, as follows:

The present ~~invention~~ exemplary embodiments relate~~s~~ to a device for detecting an abnormality or failure of a gas sensor.

Please amend the paragraph beginning at page 2, line 22, as follows:

SUMMARY OF THE ~~INVENTION~~PRESENT EXEMPLARY EMBODIMENTS.

Please amend the paragraph beginning at page 2, line 23, as follows:

The present ~~invention~~ exemplary embodiments ~~has~~ have been made in consideration of this situation, and it is therefore an object of the invention to

provide a gas sensor abnormality detecting device capable of accurately detecting the presence or absence of disconnection in a gas sensor.

Please amend the paragraph beginning at page 2, line 27, as follows:

For this purpose, in accordance with a first aspect of ~~the~~ a present ~~invention~~exemplary embodiment, there is provided a gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of the electrodes through signal lines connected to the electrodes, the device comprising signal inputting means for temporarily inputting a test signal including an alternating-current component through the signal line to the cell undergoing abnormality detection, response signal detecting means for detecting a response signal developing in the signal line in response to the inputting of the test signal, and decision means for comparing a detection value of the response signal with a prescribed value and, if the detection value resides in one of regions defined by the prescribed value, making a decision that disconnection abnormality occurs in the cell undergoing the abnormality detection.

Please amend the paragraph beginning at page 3, line 26, as follows:

According to a second aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned configuration, for the detection of the response signal, a predetermined time delay is set with respect to the test signal.

Please amend the paragraph beginning at page 4, line 12, as follows:

Furthermore, in accordance with a third aspect of ~~the~~ a present ~~invention~~exemplary embodiment, there is provided a gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor composed of a plurality of cells each having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas on surfaces of the electrodes through signal lines connected to the electrodes and made such that one electrodes of the pairs of electrodes of the plurality of cells are placed to confront a common chamber, the device comprising test signal inputting means for temporarily inputting a test signal including an alternating-current component through the signal line to a specified cell of the plurality of cells, response signal detecting means for, in response to the inputting of the test signal, detecting a response signal developing in the signal line for a cell, undergoing abnormality detection, other than the specified cell, and decision means for comparing a detection value of the response signal with a prescribed value and, if the detection value resides in preset one of

regions defined by the prescribed value, making a decision that disconnection abnormality occurs in the cell undergoing the abnormality detection.

Please amend the paragraph beginning at page 5, line 28, as follows:

According to a fourth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, the above-mentioned device according to the third aspect further comprises second response signal detecting means for, in response to the test signal with respect to the specified cell, detecting a response signal developing in a signal line for the specified cell, and second decision means for comparing a detection value of the response signal with a prescribed value to, if the detection value resides in preset one of the regions defined by the prescribed value, make a decision that disconnection abnormality occurs in the specified cell.

Please amend the paragraph beginning at page 6, line 10, as follows:

According to a fifth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, the above-mentioned device according to the fourth aspect further comprises response signal detecting means for, in response to the inputting of the test signal to the specified cell, detecting a response signal developing in a signal line for the specified cell, impedance calculating means for obtaining an impedance between the electrodes of the specified cell on the basis of the test signal and the response signal, and heater control means for controlling a heater

integrated with gas sensor together with the cell on the basis of the obtained impedance.

Please amend the paragraph beginning at page 6, line 21, as follows:

According to a sixth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, the above-mentioned device further comprises temperature state detecting means for detecting a temperature state of the solid electrolyte material and inhibiting means for inhibiting the abnormality decision processing in the decision means until the temperature state reaches a predetermined temperature region of the solid electrolyte material.

Please amend the paragraph beginning at page 7, line 5, as follows:

According to a seventh aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device according to the sixth aspect, the temperature state detecting means obtains the impedance between the electrodes on the basis of the test signal and the response signal, with the impedance being a parameter in the temperature state.

Please amend the paragraph beginning at page 7, line 15, as follows:

According to an eighth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device, the test signal inputting means inputs

a temporary voltage variation as the test signal to the signal line, and the response signal detecting means detects a variation of a current flowing through the signal line as the response signal, and the decision means sets the preset one region as a smaller region than the prescribed value and, when the detection value falls below the prescribed value, makes a decision that disconnection abnormality occurs in the cell forming the abnormality-detected object.

Please amend the paragraph beginning at page 8, line 3, as follows:

According to a ninth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device, the test signal inputting means inputs a temporary voltage variation as the test signal to the signal line, and the response signal detecting means detects a variation of a voltage in the signal line as the response signal, and the decision means sets the preset one region as a larger region than the prescribed value and, when the detection value exceeds the prescribed value, makes a decision that disconnection abnormality occurs in the cell forming the abnormality-detected object.

Please amend the paragraph beginning at page 8, line 22, as follows:

In addition, in accordance with a tenth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, there is provided a gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas

sensor composed of a cell having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas on surfaces of the electrodes through signal lines connected to the electrodes, the device comprising test signal inputting means for temporarily inputting a test signal including an alternating-current component through the signal line with respect to a cell undergoing abnormality detection, response signal detecting means for, in response to the inputting of the test signal, detecting a response signal developing in the signal line, impedance calculating means for obtaining an impedance between the electrodes on the basis of the test signal and the response signal, and decision means for comparing the obtained impedance value with a prescribed value and, if the obtained impedance value exceeds the prescribed value, making a decision that disconnection abnormality occurs in the abnormality-detected cell.

Please amend the paragraph beginning at page 9, line 22, as follows:

According to an eleventh aspect of ~~the~~ a present ~~invention~~exemplary embodiment, the above-mentioned device according to the tenth aspect further comprises temperature state detecting means for detecting a temperature state of the solid electrolyte material and inhibiting means for inhibiting the abnormality decision processing in the decision means until the temperature state reaches a predetermined temperature region of the solid electrolyte material.

Please amend the paragraph beginning at page 10, line 6, as follows:

According to a twelfth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device according to the eleventh aspect, the temperature state detecting means obtains an energizing time with respect to a heater integrated with the gas sensor together with the cell, with the energizing time being a parameter in the temperature state.

Please amend the paragraph beginning at page 10, line 19, as follows:

According to a thirteenth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device according to the eleventh aspect, the temperature state detecting means obtains a total applied electric energy to a heater integrated with the gas sensor together with the cell, with the total applied electric energy being a parameter in the temperature state.

Please amend the paragraph beginning at page 11, line 3, as follows:

According to a fourteenth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device, the aforesaid test signal inputting means constitutes a power supply of the cell and temporarily inputs a voltage variation or a current variation to the signal line, and the response signal detecting means detects a variation of current flowing through the signal line or a voltage variation between the electrodes as the response signal.

Please amend the paragraph beginning at page 11, line 13, as follows:

According to a fifteenth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device according to the fourteenth aspect, the test signal inputting means inputs a voltage or current varying in both a positive and negative directions with respect to a voltage or current immediately before.

Please amend the paragraph beginning at page 11, line 22, as follows

According to a sixteenth aspect of ~~the~~ a present ~~invention~~exemplary embodiment, in the above-mentioned device according to the fourteenth aspect, the test signal inputting means inputs a voltage or current varying in one of a positive and negative directions with respect to a voltage or current immediately before.

Please amend the paragraph beginning at page 12, line 2, as follows:

Other objects and features of ~~the~~ a present ~~invention~~ exemplary embodiment will become more readily apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings in which:

Please amend the paragraph beginning at page 12, line 5, as follows:

FIG. 1 is an illustration of a configuration of a gas concentration detecting apparatus employing an abnormality detecting device for a gas sensor according to ~~an~~ a present exemplary embodiment ~~of the present invention~~;

Please amend the paragraph beginning at page 15, line 5, as follows:

FIG. 1 is an illustration of a gas concentration detecting apparatus employing an abnormality detecting device for a gas sensor according to ~~an~~ a present exemplary embodiment ~~of the present invention~~. In this embodiment, the gas concentration detecting apparatus is for use in, for example, an internal combustion engine of a vehicle.

Please amend the paragraph beginning at page 26, line 7, as follows:

In ~~the~~ a present exemplary embodiment~~invention~~, since the pump cell voltage Vp is temporarily changed for (or within) an extremely short period of time, the resultant alternating current component produces a large pump cell current variation ΔIp through the parasitic capacity of the pump cell 1a. Even if the interference with the other cells 1b and 1c or the heater 13 integrated therewith, a fluctuation of the ground potential or the like occurs, the current variation caused by these is the degree to which the level of the pump cell current Ip varies gently. It is minute as compared with the current variation ΔIp responsive to the forced variation of the pump cell voltage Vp. Therefore, as

compared with the technique of merely checking the presence or absence of a current, the decision on the presence or absence of disconnection in the pump cell 1a can be made with more accuracy. Moreover, when the parasitic capacity in the pump cell 1a reaches a level at which the pump cell current variation ΔIp is made sufficient, the disconnection detection is feasible without waiting until the solid electrolyte layers 111 and 112 reach their activating temperatures. Accordingly, it is not always required that the prescribed value for the impedance in the aforesaid step S301 be set at an impedance value corresponding to the activating temperature region, and it is can be set to be relatively higher than the impedance value corresponding to the activating temperature region. Moreover, because of the utilization of the alternating current component produced by the variation of the pump cell voltage Vp, the LPF 231 and the LPF 241 for the disconnection detection of the monitor cell 1b, which will be mentioned later, are made so as to shape the waveform to remove the spike noises, and the cut-off frequency is set in consideration of the impedance at frequency to be detected.

Please amend the paragraph beginning at page 29, line 15, as follows:

Naturally, ~~an~~ a present exemplary embodiment ~~of the present invention~~ includes that the forced variation of the pump cell voltage Vp takes place in one direction, and it is employable in some specifications required.

Please amend the paragraph beginning at page 33, line 25, as follows:

Incidentally, in ~~the~~ a present ~~invention~~exemplary embodiment, since the disconnection detection is made on the basis of the current variation ΔIm responsive to the forced variation of the monitor cell voltage Vm, as in the case of the disconnection detection in the pump cell 1a, it is possible to more accurately make a decision on the presence or absence of a disconnection in the monitor cell 1b, as compared to the technique of merely checking the presence of absence of a current.

Please amend the paragraph beginning at page 35, line 22, as follows:

Furthermore, with respect to the cells other than the monitor cell 1b undergoing the disconnection detection, as an embodiment, the present ~~invention~~ exemplary embodiment includes that the impedance detection processing is conducted in the steps S201 to S203 to detect the temperature states of the solid electrolyte layers 111 and 112. However, for example, in the case of the impedance detection being made with respect to the sensor cell 1c, a circuit for changing the sensor cell voltage becomes necessary like the monitor cell 1b or the like, which complicates the configuration and increases the control burden. Therefore, the above-described embodiment is more practical.

Please amend the paragraph beginning at page 42, line 4, as follows:

Still additionally, although this embodiment employs a control method shown in FIG. 33 in which a pump cell voltage Vp is set in accordance with an applied voltage map on the basis of a pump cell current Ip, the present ~~invention~~ exemplary embodiment is also applicable to a technique in which, as shown in FIG. 34, a pump cell voltage Vp is feedback-controlled on the basis of a monitor cell current Im so that the monitor cell current Im takes a predetermined value.

Please amend the paragraph beginning at page 42, line 10, as follows:

Yet additionally, the gas sensor is not limited to the construction illustrated. FIG. 35 shows another example of a gas sensor to which the present ~~invention~~ exemplary embodiment is also applicable. This gas sensor, generally designated at reference numeral 1A, has a stacked construction in which built up in a thickness direction are solid electrolyte layers 151, 152, 153 made of a solid electrolyte material such as zirconia, a rate-determining layer 154 made of an insulating material such as porous alumina, a layer 155 made of an insulating material such as alumina or made of zirconia or the like, and others. It has an elongated configuration as a whole.

Please amend the paragraph beginning at page 45, line 10, as follows:

Alternatively, the present ~~invention~~ exemplary embodiment is also applicable to a gas sensor generally designated at reference numeral 1B in FIG.

36. The gas sensor 1B has the same construction as that shown in FIG. 35 except electrode configuration. In this electrode configuration, the electrode 163 shown in FIG. 35 is omitted. The solid electrolyte 151 and the electrodes 161 and 162 between which the solid electrolyte layer 151 is sandwiched constitute a first pump cell 1d, and the solid electrolyte layers 151 to 153 and the electrodes 161 and 165 constitute a first monitor cell 1h. An applied voltage to between the electrodes 161 and 162 of the first pump cell 1d is feedback-controlled on the basis of an electromotive voltage developing in the first monitor cell 1h so that the electromotive voltage becomes a reference voltage, that is, the oxygen concentration in the interior of the first chamber 141 becomes constant and takes a low value, and the oxygen in the interior of the first chamber 141 is discharged.

Please amend the paragraph beginning at page 46, line 19, as follows:

It should be understood that ~~the~~ a present ~~invention~~ exemplary embodiment is not limited to the above-described embodiment, and that it is intended to cover all changes and modifications of the present exemplary embodiments ~~of the invention~~ herein which do not constitute departures from the spirit and scope of the ~~invention~~present exemplary embodiments.